SECTION V. MAINTENANCE

4.5.1 INTRODUCTION

The wind sensor is designed to be easily maintained. There are two categories of wind sensor maintenance: preventive maintenance and corrective maintenance. Preventive maintenance consists of tasks and tests that ensure continued operation. Corrective maintenance consists of tasks that are followed to solve a problem with the unit. In both cases, the tasks are easy to perform. Furthermore, in the case of corrective maintenance, the wind sensor helps the technician locate the problem via diagnostics.

4.5.2 PREVENTIVE MAINTENANCE

The basic preventive maintenance concept includes routine inspection of the wind sensor, inspection of moving parts for damage or clogging from debris, checking of the obstruction lights, and a semiannual performance inspection of the bearings and cups. The wind sensor preventive maintenance schedule is provided in table 4.5.1.

4.5.2.1 **Routine Inspection**. Routine inspection is performed every 90 days or whenever a technician is at the site. Routine inspection consists of checking the cups and vane for physical damage and ensuring that they move freely in the wind. Any debris from insects, animals, or any other cause that shows up as a performance degradation or a potential performance degradation should be removed. Any other irregularities should be noted and any problems should be corrected. The maintenance log should be reviewed to ensure there are no electronic problems with the system.

4.5.2.2 **Obstruction Lights Check**. An operational check of the obstruction lights at the top of the wind sensor pole is performed every 90 days or whenever a technician is at the site. The obstruction lights are checked by using an opaque object to cover the photo control, which is located on top of the ac junction box beside the DCP. The obstruction lights should illuminate.

4.5.2.3 **Mechanical Operation Inspection**. Inspect the cup and vane assemblies for damage, free spin, and absence of drag to demonstrate that the bearings are operating properly and that the assemblies have not undergone any trauma since being originally balanced. Annually inspect crossarm assembly cable connector for corrosion. Table 4.5.2 provides the inspection procedures for the assemblies.

4.5.2.4 **Checking Wind Direction and Speed Data**. Semiannually, or sooner if there is a degradation of performance, the technician should check the alignment of the wind direction sensor using the procedure in table 4.5.3 or 4.5.4 and then check the data being output by the wind sensor. The wind direction data check is performed after the mechanical bearing and balance checks described above, and after the wind direction sensor has been properly aligned using the procedure in table 4.5.3 or 4.5.4. These checks use the DCP OID to observe data being reported by the direction and speed sensors. Table 4.5.5 provides the procedure to check wind direction and speed data. Wind speed performance is verified by testing the ASOS wind speed transducer, using a dual speed-driven F420 wind speed calibrator (ASN F850A-1). The calibrator uses a 60-cycle synchronous motor to provide 300, 600, and 900 rpm test speeds. The test verifies sensor electronics and throughput for the wind speed data collection package (DCP). Test results are reviewed and verified by the ASOS technician at the OID. The ASOS technician enters the results of the test in the ASOS SYSLOG. If the wind speed transducer fails to meet the specified calibration values, the wind speed transducer is replaced.

4.5.2.5 **Wind Direction Sensor Alignment Procedure**. The wind direction sensor's alignment to true north must be checked every 180 days or whenever maintenance is performed on the direction sensor or the crossarm assembly. Wind direction sensor alignment may be performed in two ways. The preferred method uses an NWS F420 translucent plastic orientation plate and adapter head to directly align the sensor based on the shadow cast at solar noon. The secondary method uses a Davis pelorus instrument to determine the offset of the wind sensor crossarm with respect to true north; the wind direction sensor is then adjusted based on the crossarm offset. The secondary method should be used when use of the preferred method is not possible. The following paragraphs provide the procedures for both of these methods.

4.5.2.5.1 **Solar Noon Wind Direction Sensor Alignment Procedure**. The preferred method of aligning the wind direction sensor is to use a special alignment tool (Figure 4.5.1) at the time of solar noon to cast a shadow at a known reference point on the tool. To perform this procedure, the maintenance technician must be able to calculate when solar noon will occur at the site. To do this, a special software program is used. The program is called SUN and runs on any laptop or PC. In order for the program to calculate solar noon for a given site, the maintenance technician must input the site's latitude and longitude, the Julian date, and the site's Greenwich Mean Time (GMT). Greenwich Mean Time is also called ZULU or UTC time. Latitude and longitude can be obtained from the ASOS site survey or the OID's site physicals page. Julian dates are shown on the Julian calendar, figure 4.5.2. With these inputs, the SUN program will provide the time that solar noon will occur for that day at that specific site. Because the sun casts a shadow at 0 degrees on the tool at solar noon, the technician must be aware of the time constraints of this procedure. When performing the procedure, the technician must calculate the time at which solar noon will occur, install the alignment tool on the wind tower, and raise the tower to a vertical position 20 minutes before solar noon occurs. At 20 minutes before solar noon, the shadow cast on the tool by the sun is checked; the shadow should occur at 5 degrees. If the shadow is not at the 5-degree mark on the “E” side of the calibration template, the technician must lower the tower, align the wind sensor's housing, and raise the tower as quickly as possible. For every 4 minutes that expire after 20 minutes before solar noon, the shadow moves approximately 1 degree; therefore, at 10 minutes before solar noon, the shadow is approximately at the 2.5-degree mark on the “E” side of the calibration template. When adjusting the wind sensor's housing, it is easy to adjust the housing in the wrong direction. If the tower is tilted to the west after servicing and the shadow is too far west at 20 minutes before solar noon, the technician must turn the housing down toward the west mark by the number of degrees that it is out. For example, if at 20 minutes before solar noon the shadow is pointing to approximately 12 degrees on the “E” side of the calibration template, the technician lowers the tower over to the west and corrects the alignment by adjusting the housing 7 degrees to the east. This is accomplished by moving the housing clockwise toward the "W" mark on the orientation plate of the tool. If the error is to the east, the technician corrects the alignment by moving the housing to the "E" mark. The solar noon alignment procedure is detailed in table 4.5.3.

4.5.2.5.2 **Davis Pelorus Instrument Wind Direction Sensor Alignment Procedure**. The secondary method of aligning the wind direction sensor uses a Davis pelorus instrument and a monocular to determine the offset of the wind sensor crossarm from true north. The wind direction sensor is then adjusted by the amount of the offset to align it to true north. To align the wind direction sensor to true north using the Davis pelorus instrument, perform the procedure in table 4.5.4.

4.5.2.6 **Cleaning and Lubrication**. The only cleaning required is to remove any debris from the wind sensor. Because all bearings are sealed, there is no requirement for lubrication. When any field replaceable unit (FRU) is removed, the connectors should be inspected for dirt and corrosion and cleaned if necessary.

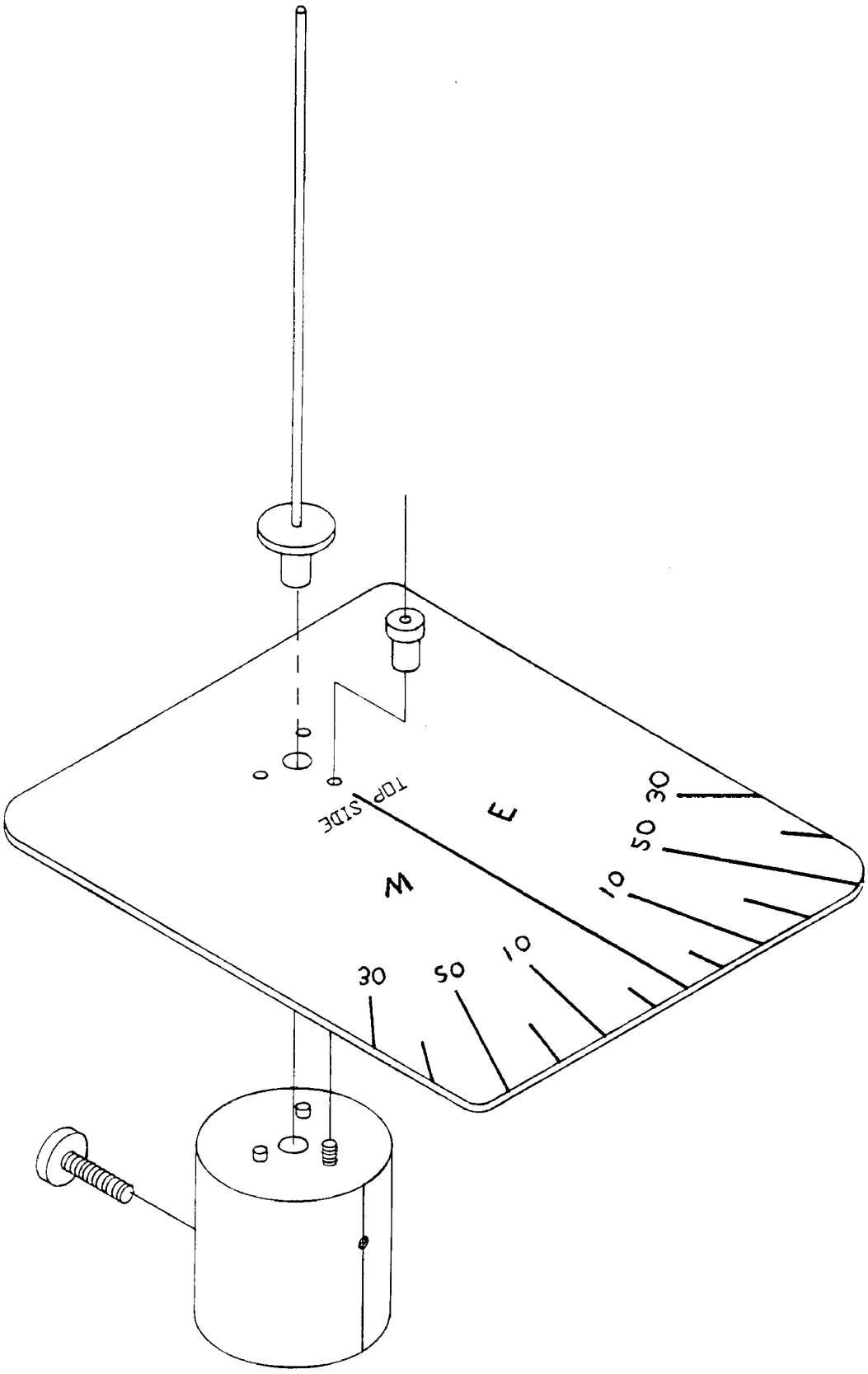

Figure 4.5.1. Wind Direction Sensor Alignment Tool

JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J
1	1	1	32	1	61	1	92	1	122	1	153	1	183	1	214	1	245	1	275	1	306	1	336
2	2	2	33	2	62	2	93	2	123	2	154	2	184	2	215	2	246	2	276	2	307	2	337
3	3	3	34	3	63	3	94	3	124	3	155	3	185	3	216	3	247	3	277	3	308	3	338
4	4	4	35	4	64	4	95	4	125	4	156	4	186	4	217	4	248	4	278	4	309	4	339
5	5	5	36	5	65	5	96	5	126	5	157	5	187	5	218	5	249	5	279	5	310	5	340
6	6	6	37	6	66	6	97	6	127	6	158	6	188	6	219	6	250	6	280	6	311	6	341
7	7	7	38	7	67	7	98	7	128	7	159	7	189	7	220	7	251	7	281	7	312	7	342
8	8	8	39	8	68	8	99	8	129	8	160	8	190	8	221	8	252	8	282	8	313	8	343
9	9	9	40	9	69	9	100	9	130	9	161	9	191	9	222	9	253	9	283	9	314	9	344
10	10	10	41	10	70	10	101	10	131	10	162	10	192	10	223	10	254	10	284	10	315	10	345
11	11	11	42	11	71	11	102	11	132	11	163	11	193	11	224	11	255	11	285	11	316	11	346
12	12	12	43	12	72	12	103	12	133	12	164	12	194	12	225	12	256	12	286	12	317	12	347
13	13	13	44	13	73	13	104	13	134	13	165	13	195	13	226	13	257	13	287	13	318	13	348
14	14	14	45	14	74	14	105	14	135	14	166	14	196	14	227	14	258	14	288	14	319	14	349
15	15	15	46	15	75	15	106	15	136	15	167	15	197	15	228	15	259	15	289	15	320	15	350
16	16	16	47	16	76	16	107	16	137	16	168	16	198	16	229	16	260	16	290	16	321	16	351
17	17	17	48	17	77	17	108	17	138	17	169	17	199	17	230	17	261	17	291	17	322	17	352
18	18	18	49	18	78	18	109	18	139	18	170	18	200	18	231	18	262	18	292	18	323	18	353
19	19	19	50	19	79	19	110	19	140	19	171	19	201	19	232	19	263	19	293	19	324	19	354
20	20	20	51	20	80	20	111	20	141	20	172	20	202	20	233	20	264	20	294	20	325	20	355
21	21	21	52	21	81	21	112	21	142	21	173	21	203	21	234	21	265	21	295	21	326	21	356
22	22	22	53	22	82	22	113	22	143	22	174	22	204	22	235	22	266	22	296	22	327	22	357
23	23	23	54	23	83	23	114	23	144	23	175	23	205	23	236	23	267	23	297	23	328	23	358
24	24	24	55	24	84	24	115	24	145	24	176	24	206	24	237	24	268	24	298	24	329	24	359
25	25	25	56	25	85	25	116	25	146	25	177	25	207	25	238	25	269	25	299	25	330	25	360
26	26	26	57	26	86	26	117	26	147	26	178	26	208	26	239	26	270	26	300	26	331	26	361
27	27	27	58	27	87	27	118	27	148	27	179	27	209	27	240	27	271	27	301	27	332	27	362
28	28	28	59	28	88	28	119	28	149	28	180	28	210	28	241	28	272	28	302	28	333	28	363
29	29	29	60	29	89	29	120	29	150	29	181	29	211	29	242	29	273	29	303	29	334	29	364
30	30			30	90	30	121	30	151	30	182	30	212	30	243	30	274	30	304	30	335	30	365
31	31			31	91			31	152			31	213	31	244			31	305			31	366

LEAP YEAR

JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J	D	J
1	1	1	32	1	60	1	91	1	121	1	152	1	182	1	213	1	244	1	274	1	305	1	335
2	2	2	33	2	61	2	92	2	122	2	153	2	183	2	214	2	245	2	275	2	306	2	336
3	3	3	34	3	62	3	93	3	123	3	154	3	184	3	215	3	246	3	276	3	307	3	337
4	4	4	35	4	63	4	94	4	124	4	155	4	185	4	216	4	247	4	277	4	308	4	338
5	5	5	36	5	64	5	95	5	125	5	156	5	186	5	217	5	248	5	278	5	309	5	339
6	6	6	37	6	65	6	96	6	126	6	157	6	187	6	218	6	249	6	279	6	310	6	340
7	7	7	38	7	66	7	97	7	127	7	158	7	188	7	219	7	250	7	280	7	311	7	341
8	8	8	39	8	67	8	98	8	128	8	159	8	189	8	220	8	251	8	281	8	312	8	342
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10	10	10	41	10	69	10	100	10	130	10	161	10	191	10	222	10	253	10	283	10	314	10	344
11	11	11	42	11	70	11	101	11	131	11	162	11	192	11	223	11	254	11	284	11	315	11	345
12	12	12	43	12	71	12	102	12	132	12	163	12	193	12	224	12	255	12	285	12	316	12	346
13	13	13	44	13	72	13	103	13	133	13	164	13	194	13	225	13	256	13	286	13	317	13	347
14	14	14	45	14	73	14	104	14	134	14	165	14	195	14	226	14	257	14	287	14	318	14	348
15	15	15	46	15	74	15	105	15	135	15	166	15	196	15	227	15	258	15	288	15	319	15	349
16	16	16	47	16	75	16	106	16	136	16	167	16	197	16	228	16	259	16	289	16	320	16	350
17	17	17	48	17	76	17	107	17	137	17	168	17	198	17	229	17	260	17	290	17	321	17	351
18	18	18	49	18	77	18	108	18	138	18	169	18	199	18	230	18	261	18	291	18	322	18	352
19	19	19	50	19	78	19	109	19	139	19	170	19	200	19	231	19	262	19	292	19	323	19	353
20	20	20	51	20	79	20	110	20	140	20	171	20	201	20	232	20	263	20	293	20	324	20	354
21	21	21	52	21	80	21	111	21	141	21	172	21	202	21	233	21	264	21	294	21	325	21	355
22	22	22	53	22	81	22	112	22	142	22	173	22	203	22	234	22	265	22	295	22	326	22	356
23	23	23	54	23	82	23	113	23	143	23	174	23	204	23	235	23	266	23	296	23	327	23	357
24	24	24	55	24	83	24	114	24	144	24	175	24	205	24	236	24	267	24	297	24	328	24	358
25	25	25	56	25	84	25	115	25	145	25	176	25	206	25	237	25	268	25	298	25	329	25	359
26	26	26	57	26	85	26	116	26	146	26	177	26	207	26	238	26	269	26	299	26	330	26	360
27	27	27	58	27	86	27	117	27	147	27	178	27	208	27	239	27	270	27	300	27	331	27	361
28	28	28	59	28	87	28	118	28	148	28	179	28	209	28	240	28	271	28	301	28	332	28	362
29	29			29	88	29	119	29	149	29	180	29	210	29	241	29	272	29	302	29	333	29	363
30	30			30	89	30	120	30	150	30	181	30	211	30	242	30	273	30	303	30	334	30	364
31	31			31	90			31	151			31	212	31	243			31	304			31	365

NONLEAP YEAR

Figure 4.5.2. Julian Calendar

Table 4.5.1. Wind Sensor Preventive Maintenance Schedule

Interval	What To Do	How To Do It
90 days	Visual inspection	Paragraph 4.5.2.1
	Check obstruction lights	Paragraph 4.5.2.2
Semiannually	Mechanical operation inspection	Table 4.5.2
	Starting torque bearing test	Paragraph 4.5.3.11 and table 4.5.17
	Wind direction alignment	Table 4.5.3
	Check wind direction and speed data	Table 4.5.5
	Cleaning and lubrication	Paragraph 4.5.2.6
Annually	Inspect crossarm cable connector	Table 4.5.2

Table 4.5.2. Mechanical Operation Inspection

Step	Procedure
1	Remove any dirt from assemblies using soap, water, and a soft cloth.
2	Inspect cup assembly and vane assembly for any physical damage such as bent or dented cups, bent arm assemblies, bent fins, or seriously cracked or chipped paint.
3	Inspect hub to ensure that shroud is not bent or rubbing sensor housing.
4	Inspect end of each cup arm (on wind speed assembly) to ensure that ends are sealed.
5	Place sensors on a level table in an upright position.
6	Slowly spin cups (and vane). The cup and vane assemblies should rotate freely with no apparent drag, resistance, or noise (squeaking).
7	When rotated on the housing, the cup assembly and vane assembly should exhibit no wobble, which indicates bent parts.
8	Slowly spin cup assembly (and vane assembly). The cup and vane assemblies should slowly come to a stop with no noticeable drag. (Any air currents may prevent the assemblies from stopping completely.) If there is drag, replace FRU.
9	Tug lightly on the end of the cup and vane assembly. Verify that there is ≤1/16th inch windshaft endplay. If endplay >1/16th-inch, replace the FRU.
10	Annually inspect connector between collector assembly and lower case for corrosion. Remove corrosion if present and apply thin coat of DC-4 anti-corrosion compound to connector pins.

Table 4.5.3. Solar Noon Wind Direction Alignment Procedure

Step	Procedure
	Tools Required: Laptop computer w/ASOS calibration program installed ¾-inch socket and ratchet ¾-inch open-end wrench ½-inch open-end wrench 7/16-inch wrench NWS F420 direction adapter head NWS F420 opaque plastic orientation plate Alignment protractor **WARNING** Before proceeding, ensure safe clearance of wind tower from dangerous areas of the runways, taxiways, or restricted zones. **NOTE** Synchronize your watch with Local Tower Time before starting this procedure.
1	Using Julian calendar (Figure 4.5.2), determine Julian date.
2	If the ACU has been downloaded from the AOMC at the OID, access the site physical page and record site's latitude and longitude. If the ACU has not been downloaded from the AOMC, obtain this information from the site survey document.
3	At the DOS prompt, enter: ASOS; then, execute menu # 1 to run the solar noon program.
4	Enter latitude and longitude in degrees, minutes, and seconds as prompted. Press <ENTER>.
5	To transfer control to the left half of menu, press F10.
6	Press N. Obtain Julian date from figure 4.5.2 and enter in right half of menu; then, press <ENTER>.
7	Solar noon, in local standard time, will be displayed on the next menu line; record result. **NOTE** When using the ASOS calibration program to determine solar noon at a specified site, adjust the displayed solar noon value by subtracting 1 hour from the result for the following regions: Time Zone — Longitude Eastern — <75° 00'00" W Central — <90° 00'00" W Mountain — <105° 00'00" W Pacific — <120° 00'00" W
8	To quit, press F10 (to transfer control to the left side of the menu) and press Q.
9	**NOTE** Steps 5 through 8 should be performed approximately 30 minutes before solar noon. Using procedure in table 4.5.8, lower wind tower.
10	Using ½-inch open-end wrench, remove lightning rod from wind tower so that its shadow does not interfere with direction reading.
11	Using procedure in table 4.5.10, remove wind direction sensor.
12	Note two scribed lines on north end of crossarm, one on the direction sensor mounting adapter and one on the pipe that is part of the crossarm.

Table 4.5.3. Solar Noon Wind Direction Alignment Procedure -CONT

Step	Procedure
13	Place direction adapter head onto alignment pin on mounting adapter and tighten thumbscrew. Place translucent plastic adapter on mounting adapter and secure with supplied thumb nut. Place indicator tube in center of mounting adapter.
14	Using procedure in table 4.5.8, raise wind tower to vertical position.
	NOTE The NWS translucent plastic plate and adapter with rod act as a sundial. The plate is divided into degrees east and west. The shadow cast by the rod onto the plate is easily visible from beneath the tower.
15	At 20 minutes before true solar noon, determine if shadow is pointing to 5-degree east mark on translucent plate. If it is not, perform the following: a. Using procedure in table 4.5.8, lower tower. b. Locate scribed line on direction sensor mounting adapter. c. Position alignment protractor immediately beneath mounting adapter (at junction with crossarm assembly) so that 0-degree mark of protractor aligns with scribed line on mounting adapter. d. Using 7/16-inch wrench, loosen hex head bolts on direction sensor mounting adapter. **NOTE** The approximate solar motion is 1 degree per 4 minutes (duration is longer during the summer as latitude approaches 90°; duration is shorter during winter). Experience has shown that the time it takes to lower tower, make the required adjustment, and raise the tower is between 3 and 5 minutes. e. Rotate direction head the number of degrees it was off the 5-degree mark. f. Using 7/16-inch wrench, tighten two mounting adapter bolts. g. Using procedure in table 4.5.8, raise tower to vertical position and verify that shadow on translucent plastic plate is now within the 5-degree west mark. For every 4 minutes that have expired after 20 minutes before true solar noon, the shadow moves approximately 1 degree.
16	At 10 minutes before solar noon, verify that shadow is centered between the 5-degree on the "E" side of the calibration template and 0-degree marks (2.5 degrees).
17	Using procedure in table 4.5.8, lower tower.
18	Remove alignment tool. Using procedure in table 4.5.10, reinstall direction sensor.
19	Coat threads of lightning rod with antiseize compound. Using ½-inch open-end wrench, install lightening rod on wind tower.
20	Using procedure in table 4.5.8, raise wind tower to vertical position.

Table 4.5.4. Davis Pelorus Alignment Procedure

Step	Procedure
	Tools Required: Davis pelorus with tripod ¾-inch socket and ratchet ¾-inch open-end wrench ½-inch open-end wrench 7/16-inch wrench NWS F420 direction adapter head NWS F420 opaque plastic orientation plate Alignment protractor **WARNING** Before proceeding, ensure safe clearance of wind tower from dangerous areas of the runways, taxiways, or restricted zones.
1	Move 100 ft. to 200 ft. away from south side of wind sensor crossarm (side with three-cup anemometer).
2	Select a position aligned with crossarm assembly using figure 4.5.3 as a guide. A monocular can aid in obtaining this alignment, especially at 200 feet.
3	Position Davis pelorus instrument tripod on a flat surface at the position selected in step 1. Use the level built-in the Davis pelorus instrument to level the instrument.
4	Rotate the entire instrument so that the instrument's north and south white markings are in alignment with the wind sensor crossarm. The north markings should point directly towards the wind tower. Use the instrument sight assembly to obtain the exact orientation as shown in figure 4.5.4.
5	Determine true north by using the Solar Noon shadow or by using a compass and allowing for local magnetic deviation. Refer to table 4.5.3 to determine Solar Noon. Using a compass requires that the north reading from the compass be corrected by adding or subtracting a few degrees to correct for the local deviation of magnetic north from true north.
6	While maintaining the Davis pelorus instrument alignment with the wind tower, rotate the sight assembly to align with true north as shown in figure 4.5.5.
7	Measure and record the difference in degrees, CW or CCW, of true north with respect to the Davis pelorus instrument markings of north. This is the heading error. A CCW heading error corresponds to true north being on the left side of the instrument (Figure 4.5.5).
8	If the heading error is less than or equal to 2 degrees, then direction alignment need not be adjusted. If the heading error is greater than 2 degrees, then it must be corrected by performing the following steps.
9	Using the procedures in tables 4.5.7 and 4.5.9, lower the wind tower and remove the wind direction sensor.
10	Observe the two scribed lines on the north end of the crossarm (one on the direction sensor mounting adapter and one on the pipe part of the crossarm).
11	Position alignment protractor at interSection of crossarm pipe and sensor mounting adapter so that the protractor zero degree mark aligns with the scribed lines on the crossarm pipe and the mounting adapter.
12	Using a 7/16-inch wrench, loosen hex head bolts on the direction sensor mounting adapter.
13	If the heading error calculated in step 7 is CW, rotate the mounting adapter CW (looking down at the sensor) to the exact number of degrees recorded in step 7; if heading error is CCW, rotate mounting adapter CCW.
14	Using a 7/16-inch wrench, tighten two mounting adapter bolts then recheck heading error using a protractor. If necessary, remark the two scribed lines on the north end of the crossarm.
15	Using the procedure in table 4.5.10, install the wind direction sensor.
16	Using the procedure in table 4.5.8, raise wind tower to a vertical position.

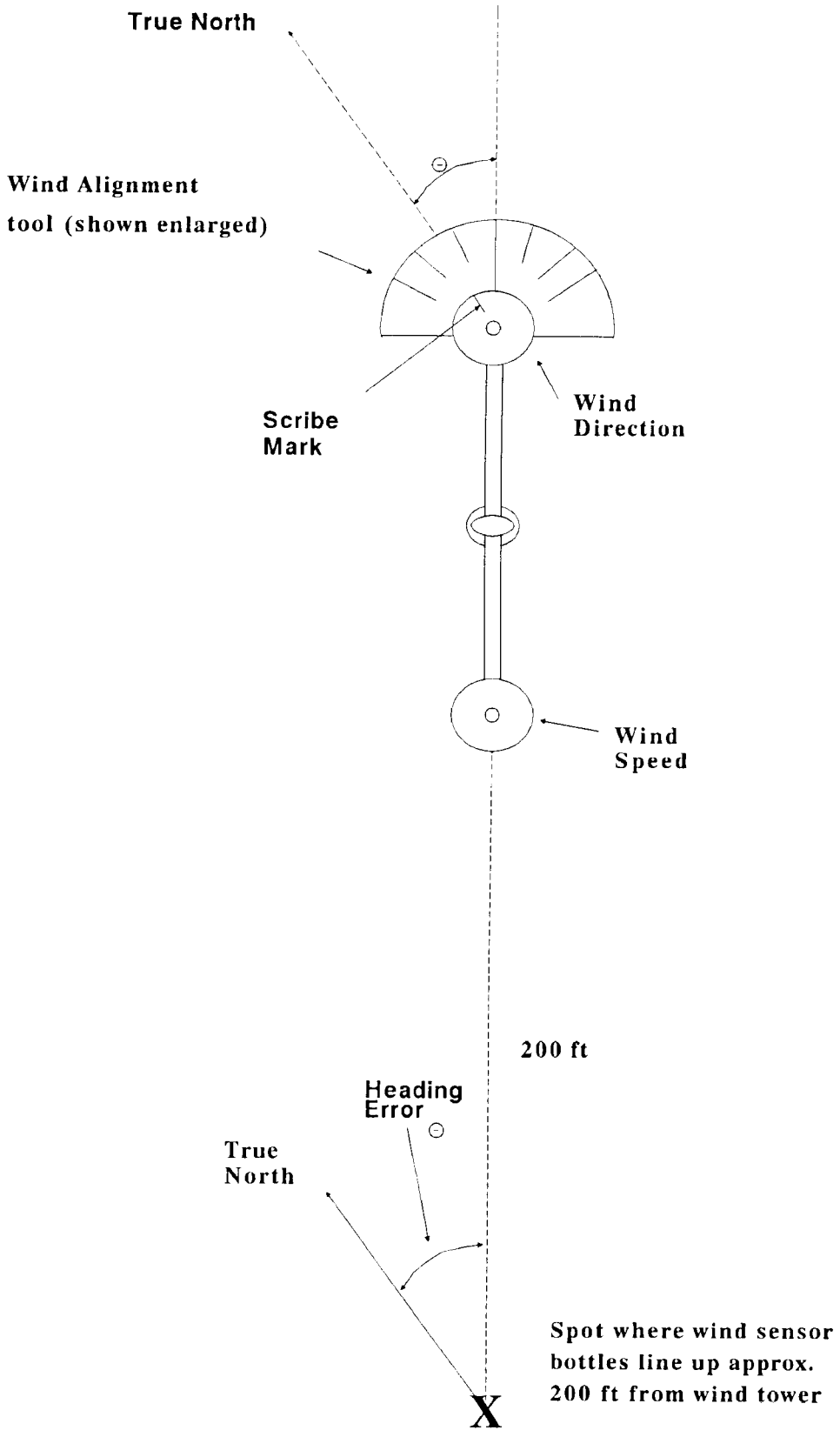

Figure 4.5.3. Wind Alignment Procedures

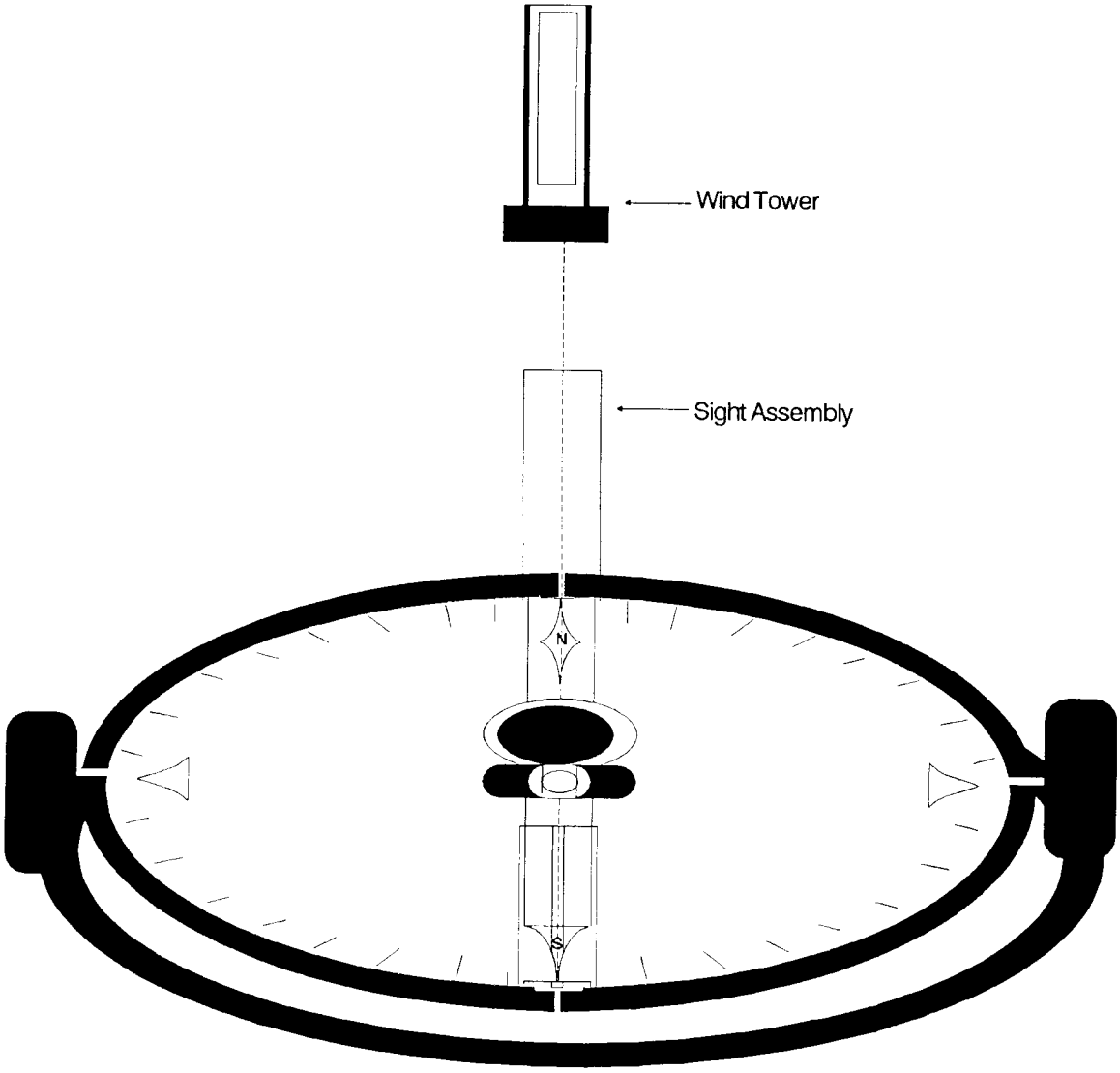

Figure 4.5.4. Davis Pelorus Instrument

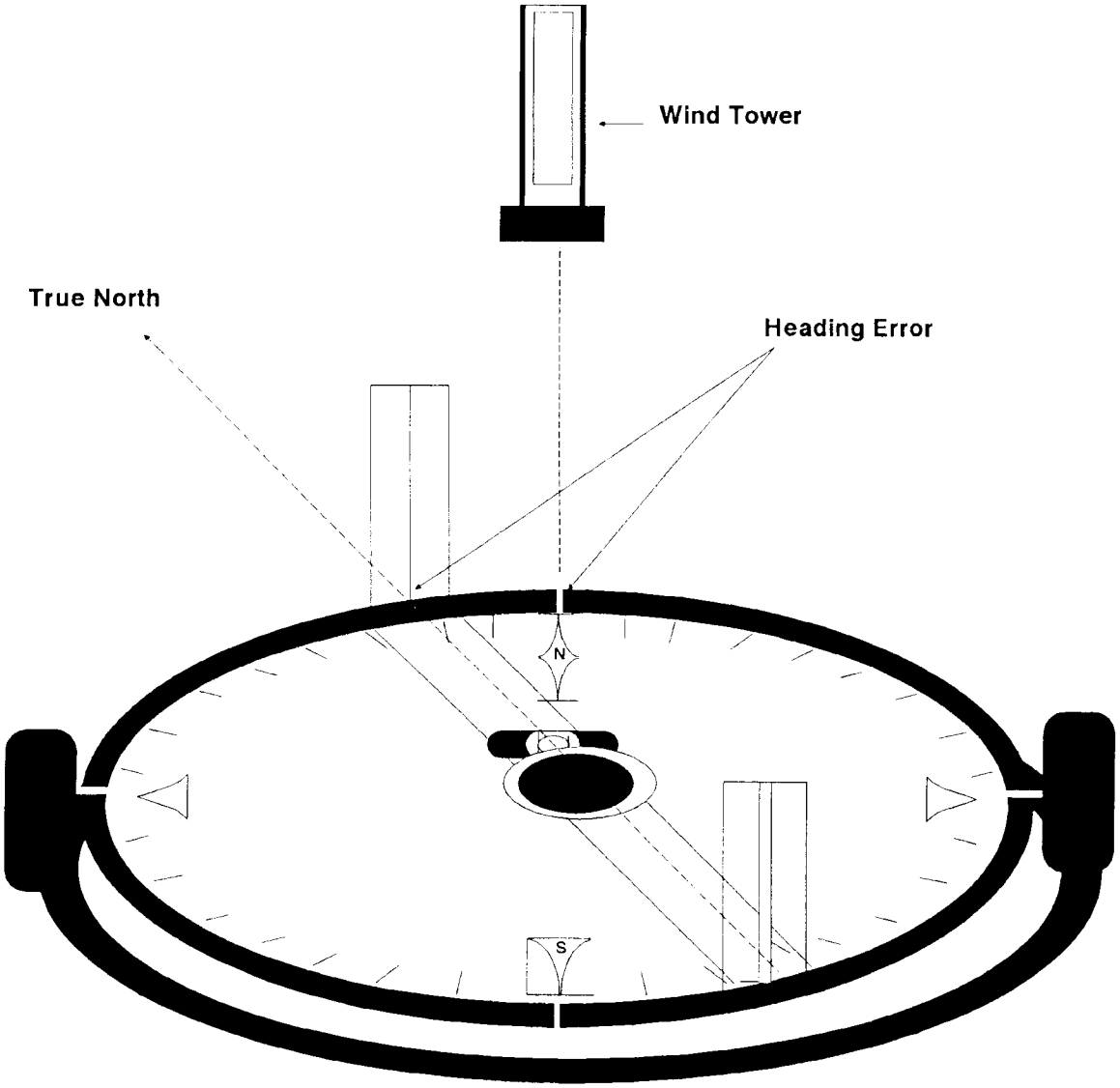

Figure 4.5.5. True North Alignment

Table 4.5.5. Checking Wind Direction and Speed Data

Step	Procedure
	NOTE Laptop computer initialized as DCP OID (paragraph 3.3.4), or any other available OID, may be used for the following procedure.
1	At OID, display sensor status page (sequentially press REVUE-SENSOR-STAT function keys from 1-minute display).
2	On sensor status page, set report processing for wind sensor to OFF.
3	Display first page of sensor 12-hour page (shows 5-second wind data) on OID (sequentially press REVUE-SENSOR-12 HR function keys from 1-minute display).
4	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.
5	At wind direction sensor, rotate direction vane to align tail of vane to alignment (north) mark on body of direction sensor. Hold in position for 2 minutes.
6	On sensor 12-hour page at OID, verify that 5-second wind data for test period indicates 180 ±10 degrees.
7	Remove cup assembly from wind speed transducer. Refer to the procedure in table 4.5.10 for cup assembly removal.
8	Remove ASOS wind speed transducer using procedure of table 4.5.9.
9	Connect ASN S100-TE321 test cable between transducer and adapter head.
10	Place transducer in position onto calibrator blocks.
11	Couple transducer to F420 wind speed calibrator using flexible coupler No. L050. The 3:1 gear speed reducer is to be used when running the 600-rpm check. **NOTE** Note the time after completion of each rpm test. This will aid in locating the results at the OID.
12	While the transmitter is coupled to the F420 calibrator, run calibrator at speeds of 300, 600, and 900 rpm. The time for each speed will be 2 minutes and 15 seconds. Ensure that calibrator is turning transmitter in same direction as 3- cup rotor is normally driven.
13	On 12-hour page of OID, note data in WIND column. Use completion time recorded earlier to locate and verify calibration data. The calibration values that must be met are listed below. These knot values are valid only with Version 2.07 wind processor firmware. RPM — Knots 300 — 27 ±2 knots 600 — 52 ±2 knots 900 — 77 ±3 knots If calibration values are not met, replace wind speed transducer. Repeat test; if the test still fails, follow standard procedures to locate and repair fault.
14	Remove F420 wind speed calibrator, remove calibrator blocks, disconnect ASN S100-TE321 test cable, connect transducer to the adapter head, and install cup assembly to transducer by repeating steps 11, 10, 9, 8, and 7.
15	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
16	Raise wind sensor tower and apply power to wind sensor in accordance with table 4.5.8.
17	AT OID, display sensor status page (sequentially press REVUE-SENSOR-STAT function keys from 1-minute display).
18	On sensor status page, set report processing for wind sensor to ON.

4.5.3 **CORRECTIVE MAINTENANCE**

4.5.3.1 **Diagnostics**. The ASOS implements diagnostics such that the type of repair is known to the technician before traveling to the field. The ASOS wind speed and wind direction sensors are provided with two types of diagnostics: continuous self-testing which runs automatically, and specific built-in tests which are executed upon demand from the ASOS. The results of both diagnostics are displayed on the wind speed/direction sensor page as described in Chapter 1.

4.5.3.2 **Troubleshooting**. The majority of wind sensor problems can be isolated by the diagnostics test. For these faults, the technician need only replace the faulty FRU as is indicated in the maintenance log. However, if a failure inhibits the diagnostics from running, it becomes the technician's responsibility to manually troubleshoot and repair the wind sensor. The troubleshooting procedures outlined in table 4.5.6 provide a basis from which the technician can isolate and repair the fault. Upon completing the repair of the wind sensor, the technician must run the on-demand diagnostics to ensure that the fault is corrected.

Table 4.5.6. Wind Sensor Troubleshooting

What To Do	How To Do It
Perform visual inspection of wind sensor.	Paragraph 4.5.2.1
Perform fiberoptic module test.	Paragraph 1.5.3.3
At DCP, verify that wind sensor ac power control module circuit breaker is set to on (left) position.	---
Perform wind sensor ac and dc power supply checks.	Table 4.5.7
If unit still does not function, troubleshoot wind sensor wiring.	Figure 4.4.2

4.5.3.3 **Lowering and Raising the Wind Tower**. Before performing certain corrective maintenance tasks, the wind tower must be lowered and secured using the polypropylene rope attached to the top of the wind tower. Technicians must stay clear of the tower while it is being lowered or raised. When the tower is secured in its horizontal position, the lightning rod must be covered to avoid severe cuts or punctures from its sharp tip. After performing maintenance actions, the tower must be raised and secured in the upright position. Table 4.5.8 provides the procedures to lower and raise the wind tower. This procedure is referenced as necessary from subsequent maintenance procedures.

4.5.3.4 **Wind Direction and Wind Speed Sensors Removal and Installation**. The wind direction and wind speed sensors are removed and installed in the same manner. Wind direction and wind speed sensors removal and installation procedures are provided in table 4.5.9. The wind speed transducer, cup assembly, direction transducer, and vane assembly are all FRU's. For this reason, the cup assembly or the vane assembly must be removed from its respective transducer before replacing one of the four FRU's. Table 4.5.10 provides procedures to remove and install a cup assembly or vane assembly. The cup assembly and vane assembly may be removed while the sensor is mounted on the crossarm assembly or after the sensor has been removed from the crossarm assembly.

4.5.3.5 **Power Supply Removal and Installation**. Removal and installation procedures for the power supply are provided in table 4.5.11.

4.5.3.6 **Fiberoptic Module Removal and Installation**. Removal and installation procedures for the fiberoptic module are provided in table 4.5.12.

4.5.3.7 **Processor Board Removal and Installation**. Removal and installation procedures for the processor board are provided in table 4.5.13.

4.5.3.8 **Wind Sensor Electronics Enclosure Removal and Installation**. Removal and installation procedures for the wind sensor electronics enclosure are provided in table 4.5.14.

4.5.3.9 **Wind Tower Signal Cable W1 Removal and Installation**. Removal and installation procedures for the tower signal cable W1 are provided in table 4.5.15.

4.5.3.10 **Crossarm Assembly Removal and Installation**. Removal and installation procedures for the crossarm assembly are provided in table 4.5.16.

4.5.3.11 **Starting Torque Bearing Test**. A performance check of the wind sensor includes performing a starting torque bearing test. The starting torque of the wind speed and wind direction housings is measured to detect bearing condition. As the bearings in each housing age, they tend to show an increase in friction which can be easily measured. Bearings that measure within the allocated starting torque values will ensure that the wind cups and vanes are responsive at low wind speeds. The starting torque bearing test is performed every 6 months and prior to installation of a new cup or vane assembly using the procedures in table 4.5.17.

Table 4.5.7. Wind Sensor AC and DC Power Supply Checks

Step	Procedure
	Tools required: No. 1 Phillips screwdriver **NOTE** AC and dc power supply checks should be performed on wind sensor as part of troubleshooting procedure when a malfunction interrupts communications between sensor and ASOS.
1	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
2	At wind sensor, open electronics enclosure access door.
3	At electronics enclosure, use No. 1 Phillips screwdriver to remove six screws securing power input box access cover.
4	Remove access cover from power input box.
5	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.
6	**WARNING** Dangerous voltages are present within wind sensor electronics enclosure when wind sensor is powered on. Using digital multimeter (DMM), measure ac voltage between terminals 1 and 2 on terminal board TB1 in power input box. Voltage should be 110 vac ±10%. If correct voltage is not obtained, troubleshoot ac wiring back to DCP.
7	Using DMM, measure ac voltage between LINE OUT and NEUTRAL studs on line protector (E2) in power input box. Voltage should be 110 vac ±10%. If correct voltages are not obtained, replace wind sensor electronics enclosure.
8	Check fuse F2 (heater fuse) and replace if blown. If fuse blows again, replace wind sensor electronics enclosure.
9	Using DMM, measure dc voltage between power supply (PS1) terminals marked +OUT and -OUT. Voltage should be between 4.5 and 5.5 vdc. If correct voltage is not obtained, remove power, disconnect wires from +OUT and -OUT terminals, reapply power, and check voltage outputs again. If correct voltage is still not obtained, replace power supply PS1.

Table 4.5.7. Wind Sensor AC and DC Power Supply Checks -CONT

Step	Procedure
10	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
11	Install load wires to +OUT and -OUT terminals of power supply PS1.
12	Loosen screw securing data processing board A2 to vertical support post and remove data processing board from its edge connector.
13	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.
14	Using DMM, measure dc voltage between power supply (PS1) terminals marked +OUT and -OUT. Voltage should be between 4.5 and 5.5 vdc. If correct voltage is obtained, replace data processing board A2. If correct voltage is still not obtained, replace wind sensor electronics enclosure.
15	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
16	Install data processing board on vertical support post and tighten screw.
17	Install power input box access cover and using No. 1 Phillips screwdriver, install six screws securing cover.
18	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.

Table 4.5.8. Lowering and Raising Wind Tower

Step	Procedure
	LOWERING TOWER
	Tools required: ¾-inch socket and ratchet ¾-inch open-end wrench
1	Inside DCP cabinet, set circuit breaker on wind sensor circuit breaker module to off (right) position.
2	Select direction (east or west) to which tower is to be lowered.
3	At opposite side of tower (west or east), use socket, ratchet, and open-end wrench to remove two nuts, lockwashers, and bolts securing top horizontal retaining beam (Figure 4.1.1) to vertical supports. Remove top horizontal retaining beam.
4	Release lower end of tower guide rope.
	WARNING Wind tower is counterbalanced and swings freely when horizontal retaining beams are removed. Death or severe injury may result if personnel are not kept out of travel path of wind tower. Throughout this procedure, use guide rope to control tower, and ensure that personnel are kept out of travel path of tower. Tower may move unpredictably in heavy winds or if counterbalance is distorted (due to ice accumulation, FRU's removed from sensor, etc). Use caution when lowering tower under such conditions.
5	While maintaining control of tower guide rope, use socket, ratchet, and open-end wrench to carefully remove two nuts, lockwashers, and bolts securing bottom horizontal retaining beam to vertical supports. Remove bottom horizontal retaining beam.
6	Using tower guide rope, slowly lower tower until its travel is stopped by remaining upper horizontal retaining beam.

Table 4.5.8. Lowering and Raising Wind Tower -CONT

Step	Procedure
	WARNING Tower must be secured in horizontal position using tower guide rope before removing sensors, crossarm assembly, counterbalance weights, or before performing other maintenance that affects counterbalance of tower. Failure to comply may result in death or severe injury.
7	Secure tower in horizontal position by securing free end of tower guide rope to stationary object (such as nearest sensor pedestal).
	WARNING The lightning rod is very sharp and can inflict serious injuries to technicians servicing the sensors. Prior to servicing the sensors while the tower is in the horizontal position, the lightning rod must be covered.
8	Devise or obtain a covering having hollow dimensions suiTable to enclose lightning rod (7 inches deep by 1-1/2 inches in diameter). The cover can be made of plastic, styrofoam, wood, cardboard, or suiTable packing material. Cover lightning rod.
	RAISING TOWER
	Tools required: 3/4-inch socket and ratchet 3/4-inch open-end wrench
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor power control module is set to off (right) position.
	WARNING Death or severe injury may result if personnel are not kept out of travel path of wind tower. Throughout this procedure, use guide rope to control tower, and ensure that personnel are kept out of travel path of tower. Tower may move unpredictably in heavy winds or if counterbalance is distorted (due to ice accumulation, FRU's removed from sensor, etc). Use caution when raising tower under such conditions.
2	Remove lightning rod cover.
3	Release tower guide rope from stationary object.
4	Using tower guide rope, slowly raise tower to upright position.
	NOTE Bolts are installed from outboard side of vertical supports. Lockwashers and nuts are installed from inboard side.
5	While maintaining control of tower guide rope, use socket, ratchet, and open-end wrench to carefully install two bolts, lockwashers, and nuts securing bottom horizontal retaining beam to vertical supports.
6	Secure free end of tower guide rope to tower.
7	Using socket, ratchet, and open-end wrench, install two bolts, lockwashers, and nuts securing top horizontal retaining beam to vertical supports.
8	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.

Table 4.5.9. Wind Direction and Wind Speed Sensors Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: 7/16-inch wrench
1	Remove power from wind sensor and lower wind tower in accordance with table 4.5.8.
	CAUTION When removing wind direction sensor, loosen only captive bolts on sensor itself. Do not loosen or adjust bolts securing mounting flange to crossarm. Failure to comply may alter sensor alignment.
2	At base of sensor, use 7/16-inch wrench to loosen two captive bolts (Figure 4.2.1) until bolts are free of sensor housing. Ensure that bolts are disengaged from threads.
3	Firmly grasp sensor and pull straight off of crossarm support mounting flange.
	INSTALLATION
	CAUTION When installing wind direction sensor, tighten only captive bolts on sensor itself. Do not tighten or adjust bolts securing mounting flange to crossarm assembly. Failure to comply may alter sensor alignment.
1	Install new sensor by aligning guide pins and connector on sensor with mounting holes and receptacle in crossarm support mounting flange.
	CAUTION Bolts securing sensor to crossarm support must be tightened as directed below. Failure to follow these procedures may result in cross threading of holes in sensor and damage to internal connectors.
2	Tighten each captive bolt ½ turn.
3	Using 7/16-inch wrench, alternately tighten each captive bolt ½ turn at a time. Continue this process until both bolts are tight.
4	Raise wind sensor tower and apply power to wind sensor in accordance with table 4.5.8.

Table 4.5.10. Cup Assembly and Vane Assembly Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver 1/8-inch hex key wrench
1	If removing cup or vane assembly while respective sensor is still mounted to crossarm assembly, remove power from wind sensor and lower wind tower in accordance with table 4.5.8.
	NOTE Cone-shaped cap on top of cup assembly or vane assembly is lefthand thread. Turn screwdriver clockwise to loosen and counterclockwise to tighten.
2	Using large flat-tipped screwdriver, remove cone-shaped cap securing cup assembly or vane assembly to transducer shaft and remove Seeloc washer.

Table 4.5.10. Cup Assembly and Vane Assembly Removal and Installation -CONT

Step	Procedure
3	Using hex key wrench, loosen setscrew securing cup assembly or vane assembly to transducer shaft. Lift cup assembly or vane assembly from transducer shaft. **NOTE** The Mod 0 wind speed transducer is subject to bearing failures, excessive torque, and moisture problems; for these reasons it is suggested that any remaining Mod 0 units, upon failure of the unit, be replaced with Mod 1, or preferably, the Mod 2 wind speed transducers. The Mod 1 wind speed transducer can be identified by the manufacturers part number 32228 MOD 1 stamped onto the identification plate on the side of the unit. The Mod 1 unit corrected the internal problems of the Mod 0 transducer; however, the relatively flat top of the Mod 0 and Mod 1 transducers can allow ice buildup which could degrade the performance of the unit in severe cold weather. For this reason, it is recommended that the Mod 1 wind speed transducer not be used in climates where icing is prevalent.
INSTALLATION	
Tools required: 1/8-inch hex key wrench Test fixture S100-TE329 (NLSC)	
1	If installing cup assembly or vane assembly while respective transducer is mounted to crossarm assembly, ensure that power is removed from wind sensor and tower is lowered in accordance with table 4.5.8.
2	Attach the 0.374-in. diameter dowel (p/o test fixture S100-TE329) to the wind vane hub. Tighten the setscrew enough to hold the drill blank from rotating but do not overtighten. Slide the clearance gauge (p/o test fixture S100-TE329) onto the dowel.
3	Invert the wind vane assembly so that gravity causes the clearance gauge to fall into the skirt. Observe that the clearance gauge falls freely to the bottom of the skirt and is fully seated on the hub.
4	Repeat step 3 several times, and observe whether the clearance gauge contacts skirt sidewalls and/or fails to contact the hub. If either of these unsatisfactory conditions exists, the wind vane assembly should be rejected: it cannot be used on the MOD 2 wind bottle.
5	Remove the test fixture from the wind vane. If the wind vane passed the test of steps 3 and 4 above, attach it to a MOD 2 bottle and manually spin the wind vane while looking upward to inspect clearance; verify that there is no contact between skirt sidewalls and bottle neck.
6	Position vane assembly on shaft of corresponding transducer. Install wind direction vane, ensuring that setscrews are aligned with flat surface of wind direction bottle shaft. Using hex key wrench, tighten the setscrew that secures vane assembly to transducer shaft.
7	Attach the 0.374-in. diameter dowel to the windspeed cup hub by sliding the dowel into the center hole and tightening the setscrew until the dowel can not rotate but do not overtighten.
8	Slide clearance gauge onto dowel.
9	Hold the windspeed cup assembly inverted so that gravity causes the clearance gauge to fall into the skirt. Observe that the clearance gauge falls freely to the bottom of the skirt and is fully seated on the hub.
10	Repeat step 9 several times and observe whether the clearance gauge contacts the skirt sidewalls, and/or, fails to contact the hub. If either of these unsatisfactory conditions exists, the windspeed cup assembly should be rejected: it cannot be used on the MOD 2 wind bottle.

Table 4.5.10. Cup Assembly and Vane Assembly Removal and Installation -CONT

Step	Procedure
11	Remove the test fixture from the windspeed cup assembly. If the windspeed cup assembly passed steps 9 and 10 above, attach the windspeed cup to the MOD 2 (or current configuration) bottle. Hold this assembly upright and manually spin the cup assembly while looking upward under the skirt to verify that the skirt sidewalls do not contact the bottle neck. **NOTE** If either the wind vane assembly or the windspeed cup assembly were to fail the above concentricity tests, they should be identified accordingly and returned to NRC.
12	Position cup assembly on shaft of corresponding transducer. Using hex key wrench, tighten setscrew securing cup assembly to transducer shaft.
13	Install Seeloc washer on transducer shaft.
	NOTE Cone-shaped cap on top of cup assembly or vane assembly is lefthand threaded. Turn screwdriver clockwise to loosen; counterclockwise to tighten.
14	Using large flat-tipped screwdriver, install cone-shaped cap securing cup assembly or vane assembly to transducer shaft.
15	If transducer is already mounted to crossarm assembly, raise wind tower and apply power to wind sensor in accordance with table 4.5.8.

Table 4.5.11. Power Supply Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver Small flat-tipped screwdriver No. 0 Phillips screwdriver No. 1 Phillips screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
2	Using large flat-tipped screwdriver, open wind sensor electronics enclosure access door.
3	Using flat-tipped screwdriver, tag and remove wires from power supply terminals.
4	Using No. 0 Phillips screwdriver, loosen screw securing data processing board to support post (standoff) such that data processing board is freed from post.
5	Using No. 1 Phillips screwdriver, remove two screws and flat washers securing power supply angle mount to wind sensor electronics enclosure. Carefully lift power supply with angle mount from electronics enclosure.
6	Using No. 0 Phillips screwdriver, remove four screws, lockwashers, and flat washers securing power supply to angle mount.

Table 4.5.11. Power Supply Removal and Installation -CONT

Step	Procedure
	INSTALLATION
	Tools required: Large flat-tipped screwdriver Small flat-tipped screwdriver No. 0 Phillips screwdriver No. 1 Phillips screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor power control module is set to off (right) position.
2	Using No. 0 Phillips screwdriver, install four flat washers, lockwashers, and screws securing power supply to angle mount.
3	With terminals positioned to the left, slide power supply with angle mount into position.
4	Using No. 1 Phillips screwdriver, install two flat washers and screws securing power supply angle mount to wind sensor electronics enclosure.
5	Using flat-tipped screwdriver and tags as a guide, connect wires to power supply terminals.
6	Using No. 0 Phillips screwdriver, install screw securing data processing board to support post (standoff) on power supply mounting angle.
7	Close and secure wind sensor electronics enclosure access door.
8	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.

Table 4.5.12. Fiberoptic Module Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver Medium flat-tipped screwdriver Small flat-tipped screwdriver No. 1 Phillips screwdriver (short) **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
2	Using large flat-tipped screwdriver, open wind sensor electronics enclosure access door.
3	Using small flat-tipped screwdriver, loosen two retaining screws on DB-9 connector located on top of fiberoptic module. Remove DB-9 connector.
4	Remove six screws and lockwashers securing power input box access cover.
5	Remove access cover from power input box.

Table 4.5.12. Fiberoptic Module Removal and Installation -CONT

Step	Procedure
6	Using counterclockwise (ccw) rotation, remove two fiberoptic cables from rear of fiberoptic module. Install protective plastic covers over fiberoptic connectors. **NOTE** Screws referenced in next step are located inside power input box.
7	At wind sensor electronics enclosure, use No. 1 Phillips screwdriver to remove four screws, lockwashers, flat washers, and nuts securing fiberoptic module mounting plate to power input box. Remove fiberoptic mounting plate and gasket.
8	Using small flat-tipped screwdriver, remove four screws, lockwashers, and gaskets securing fiberoptic module to mounting plate.
INSTALLATION	
	Tools required: Large flat-tipped screwdriver Medium flat-tipped screwdriver Small flat-tipped screwdriver No. 1 Phillips screwdriver (short) **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor power control module is set to off (right) position.
2	Using small flat-tipped screwdriver, install gaskets, four lockwashers, and screws securing fiberoptic module to mounting plate.
3	With DCP connector toward the front, position fiberoptic module mounting plate and gasket on power input box. Using No. 1 Phillips screwdriver, install four nuts, flat washers, lockwashers, and screws securing fiberoptic module to power input box.
4	Remove protective plastic covers from fiberoptic connectors and connect receive (RX) cable to front connector and transmit (TX) cable to rear connectors to fiberoptic module.
5	Install power input box access cover and secure using six lockwashers and screws.
6	Install signal cable to DB-9 connector on fiberoptic module. Using small flat-tipped screwdriver, tighten two retaining screws.
7	Using large flat-tipped screwdriver, close and secure wind sensor electronics enclosure access door.
8	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.

Table 4.5.13. Processor Board Removal and Installation

Step	Procedure
	REMOVAL
	Tools Required: Large flat-tipped screwdriver No. 1 Phillips screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.
2	Using large flat-tipped screwdriver, open wind sensor electronics enclosure access door.
3	Using No. 1 Phillips screwdriver, remove screw securing processor board to standoff.
4	Carefully remove processor board by pulling it free from its connector.
	INSTALLATION
	Tools required: No. 1 Phillips screwdriver Large flat-tipped screwdriver **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor power control module is set to off (right) position.
2	Insert processor board into its corresponding connector inside electronics enclosure.
3	Using No. 1 Phillips screwdriver, install screw securing processor board to standoff.
4	Using large flat-tipped screwdriver, close and secure wind sensor electronics enclosure access door.
5	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.

Table 4.5.14. Wind Sensor Electronics Enclosure Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver No. 1 Phillips screwdriver Large adjusTable wrench **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to off (right) position.

Table 4.5.14. Wind Sensor Electronics Enclosure Removal and Installation -CONT

Step	Procedure
2	Using large flat-tipped screwdriver, open wind sensor electronics enclosure access door.
3	Using No. 1 Phillips screwdriver, remove six screws securing access cover to power input box. Remove access cover.
4	Disconnect ac power input wires from terminals TB1-1, TB1-2, and TB1-3 inside power input box.
5	Using ccw rotation, disconnect two fiberoptic cables from underneath fiberoptic module. Install protective plastic covers over fiberoptic cable connectors.
6	Disconnect connectors P1 and P2 of tower signal cable W1 from connectors J1 and J2 in electronics enclosure.
7	Using large adjusTable wrench, disconnect both flexible conduits from electronics enclosure.
8	Carefully retract flexible conduits while sliding signal and ac power cables out of electronics enclosure.
9	While supporting electronics enclosure, loosen four captive bolts securing electronics enclosure to tower.
10	Remove electronics enclosure.
	INSTALLATION
	Tools required: Large flat-tipped screwdriver No. 1 Phillips screwdriver Large adjusTable wrench **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor power control module is set to off (right) position.
2	Position wind sensor electronics enclosure on tower.
3	Tighten four captive bolts securing electronics enclosure to tower.
4	Using large flat-tipped screwdriver, open electronics enclosure access door.
5	Using No. 1 Phillips screwdriver, remove six screws securing power input box access cover. Remove access cover.
6	Carefully slide ac power and signal cables through holes in bottom of electronics enclosure. Using large adjusTable wrench, secure flexible conduits to electronics enclosure.
7	Connect ac power wiring to terminal board TB1 in power input box according to the following connection chart: Wire color — Terminal — Function Black — TB1-1 — 110 vac White — TB1-2 — Neutral Green — TB1-3 — Chassis ground If power input box has two filters and surge suppressors, ensure that the following jumpers are also in place: From — To TB1-1 (black) — TB1-4 TB1-2 (white) — TB1-5
8	Remove protective plastic covers from two fiberoptic cable connectors underneath fiberoptic module.
9	Referring to stencils on fiberoptic module, connect transmitter cable (TX) to transmitter connector (XMTR) and receiver cable (RX) to receiver connector (RCVR).
10	Install access cover on power input box and using No. 1 Phillips screwdriver, install six screws securing cover.
11	Connect connectors P1 and P2 of tower signal cable W1 to connectors J1 and J2 in electronics enclosure.
12	Using large flat-tipped screwdriver, close and secure electronics enclosure access door.

Table 4.5.14. Wind Sensor Electronics Enclosure Removal and Installation -CONT

Step	Procedure
13	Inside DCP equipment cabinet, set circuit breaker on wind sensor power control module to on (left) position.

Table 4.5.15. Wind Tower Signal Cable W1 Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: Large flat-tipped screwdriver Medium flat-tipped screwdriver No. 1 Phillips screwdriver No. 3 Phillips screwdriver Large adjusTable wrench Electrical fishtape (optional) **WARNING** Death or severe injury could result if power is not removed from sensor prior to maintenance activities. Ensure that sensor circuit breakers CB1 and CB2 (located in DCP) are off (right position). **NOTE** It is recommended that two persons work together to accomplish this procedure.
1	Open AC Junction Box; turn off circuit breaker for obstruction lights.
2	Open DCP; set wind sensor power control module circuit breaker off (toward right).
3	Open wind sensor electronics enclosure door.
4	Unplug two signal cable connectors W1P1 and W1P2.
5	Attach pullcord or pullwire to cable connectors to aid in installation of replacement cable.
6	Remove cover of pivot junction box. (See figure 4.2.1.)
7	Remove tower access plate.
8	Pull cable W1 (and pullcord) back through pivot pipe to access plate opening. **NOTE** Obstruction light wires might have to be removed temporarily from pivot pipe to allow enough space for connectors to pass.
9	Remove crossarm. (Refer to table 4.5.16.) If tower is being lowered toward the side with the access plate (usually on the east side), be careful not to pinch cable between access plate opening edge and top horizontal retaining beam.
10	Pull cable W1 (and pullcord) back through top of tower and detach pull cord.
11	If installation will not be accomplished immediately, proceed as follows: a. Tie off both ends of pullcord. b. Connect obstruction light wires. c. Install tower access plate. d. Install pivot junction box cover. e. Raise tower. (Refer to table 4.5.8.) f. Close all three enclosures. g. Turn on obstruction lights circuit breaker.

Table 4.5.15. Wind Tower Signal Cable W1 Removal and Installation -CONT

Step	Procedure
	INSTALLATION
	Tools required: Large flat-tipped screwdriver Medium flat-tipped screwdriver No. 1 Phillips screwdriver No. 3 Phillips screwdriver Large adjusTable wrench Electrical fishtape (optional) **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to off (right) position.
1	Repeat/check removal steps 1, 2, 3, 6, 7, and 9.
2	Use vinyl electrical tape to cover and protect connectors while pulling the cable. Use the pullcord installed in Removal step 5, or use an electrician's fishtape to pull replacement W1 cable into tower, pivot pipe, and flex conduit. Ensure that W1P3 will be positioned at tower top while W1P1 and W1P2 will be at the wind electronics enclosure.
3	Install crossarm. (Refer to table 4.5.16.)
4	At the tower access opening, leave slack in the cable to form a drip loop.
5	In the wind electronics enclosure, connect plugs W1P1 and W1P2 into A1J1 and A1J2, respectively.
6	Install tower access plate and pivot junction box cover.
7	Set circuit breakers on; verify that obstructions lights and wind sensor are operating.
8	Close all three enclosures and verify that obstruction lights and wind sensor continue operating.

Table 4.5.16. Crossarm Assembly Removal and Installation

Step	Procedure
	REMOVAL
	Tools required: 7/16-inch wrench **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to the off (right) position.
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor circuit breaker module is set to off (right) position.
2	Using the procedures in table 4.5.8, lower wind tower.
3	At base of wind direction sensor, use 7/16-inch wrench to loosen two captive bolts (Figure 4.2.1) until bolts are free of sensor housing. Ensure that bolts are disengaged from threads.
4	Firmly grasp wind direction sensor and pull straight off crossarm support mounting flange.
5	At base of wind speed sensor, use 7/16-inch wrench to loosen two captive bolts (Figure 4.2.1) until bolts are free of sensor housing. Ensure that bolts are disengaged from threads.
6	Firmly grasp wind speed sensor and pull straight off crossarm support mounting flange.
7	Referring to figure 4.2.2, remove two bolts, flat washers, and nuts securing crossarm support to tower.

Table 4.5.16. Crossarm Assembly Removal and Installation -CONT

Step	Procedure
8	Carefully slide vertical section of crossarm support off top of tower and remove and retain any shims which may be present. Disconnect connector W1P3 of tower signal cable from connector J1 of crossarm support and remove crossarm from tower.
9	Clean off any RTV732 sealant that may remain on tower mounting post.
	INSTALLATION
	Tools required: RTV732 sealant (or equivalent) DC-4 anti-corrosion compound Wind tower shims (62828-40224) 7/16-inch wrench **WARNING** Death or severe injury may result if power is not removed from sensor prior to maintenance activities. Ensure that circuit breaker (located in DCP) supplying power to sensor is set to the off (right) position.
1	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor circuit breaker module is set to off (right) position.
2	**NOTE** Crossarm is mounted to top of tower such that wind direction sensor end of crossarm points due north and holes in tower are aligned with holes in crossarm support. Lower wind tower in accordance with table 4.5.8 to gain safe access to top of tower.
3	Apply thin coat of DC-4 anti-corrosion compound to connector pins and connect tower connector W1P3 signal cable to crossarm support connector J1.
4	Install crossarm support in top of tower.
5	Rotate crossarm support such that wind direction sensor end of crossarm support (lower arm) points due north and holes in tower are aligned with holes in crossarm support.
6	Referencing figure 4.2.2, install two bolts, flat washers, and nuts securing crossarm support to tower. Install the required number of wind tower shims to remove any excessive play between crossarm support and tower. Tighten two bolts securing crossarm support to tower.
7	Using RTV732 sealant or equivalent, seal seam around base of crossarm support. **CAUTION** When installing wind direction sensor, tighten only captive bolts on sensor itself. Do not tighten or adjust bolts securing mounting flange to crossarm assembly. Failure to comply may alter sensor alignment.
8	Install wind direction sensor by aligning guide pins and connector on sensor with mounting holes and receptacle in crossarm support mounting flange. **CAUTION** Bolts securing sensor to crossarm support must be tightened as directed below. Failure to follow these procedures may result in cross threading of holes in sensor and damage to internal connectors.
9	Tighten each captive bolt ½ turn.
10	Using 7/16-inch wrench, alternately tighten each captive bolt ½ turn at a time. Continue this process until both bolts are tight.
11	Install wind speed sensor by aligning guide pins and connector on sensor with mounting holes and receptacle in crossarm support mounting flange.

Table 4.5.16. Crossarm Assembly Removal and Installation -CONT

Step	Procedure
	CAUTION Bolts securing sensor to crossarm support must be tightened as directed below. Failure to follow these procedures may result in cross threading of holes in sensor and damage to internal connectors.
12	Tighten each captive bolt ½ turn.
13	Using 7/16-inch wrench, alternately tighten each captive bolt ½ turn at a time. Continue this process until both bolts are tight.
14	Raise wind tower in accordance with table 4.5.8.
15	Align wind direction sensor by performing procedure in table 4.5.3.
16	Inside DCP equipment cabinet, ensure that circuit breaker on wind sensor module is set to on (left) position.

Table 4.5.17. Starting Torque Bearing Test

Step	Procedure
	Tools required: Precision torque gauge (Seekonk model SO-3)
1	Using procedures in table 4.5.9, remove wind speed and wind direction sensors from crossarm support.
2	Position wind speed sensor on a flat surface in an area protected from wind or any air movement.
3	Using flat blade bit attached to torque gauge, install torque gauge in slot of nut that secures cups to housing shaft.
4	Holding torque gauge vertical, slowly turn clockwise and read indicated torque at which cups just begin to turn. Record reading.
5	Repeat step 4 two more times.
6	Repeat steps 4 and 5, but this time turn torque gauge in a counterclockwise direction.
7	Average six recorded values to determine starting torque of sensor. If value is greater that 0.25 inch-ounce, replace sensor.
8	Repeat steps 2 through 7 for wind direction sensor.
9	Using procedures in table 4.5.9, install wind speed and wind direction sensors.